Handling the Combined Consequence of Chemicals or the Combination of Chemicals and Radionuclides.

CSIG Issue C4

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Combined Consequence of Chemicals or the Combination of Chemicals and Radionuclides

- Issue Background and chronology
- Team member's list
- Project goals
- Progress to date
- Problems
- Next steps
- Recommendations to senior management

Issue background and chronology

- Consequences of exposure to several radio-nuclides routinely added
- Consequences of exposure to mixtures of chemicals have been treated separately
- Simultaneous exposure to radionuclides and chemicals have also been treated separately
- Current approach is NOT conservative

Team member's list

- Doug Craig, WSMS, Aiken, SC
- Doan Hansen, BNL, Upton, NY
- Sarah Lane, LLNL, Livermore, CA
- Larry Lee, INEEL, Idaho Falls, ID
- Ann Schubert, DOE, West Valley, NY
- David Seidel, LLNL, Los Alamos, NM
- Steve Wilson, WSRC, Aiken, SC

Project goals

- Prepare methodology for analyzing
  - ➢ effects of exposure to mixtures of chemicals
  - ➢ effects of simultaneous exposure to chemicals and radionuclides
- Submit recommendations to DOE for inclusion in Guidance Documents
- Integrated Safety Management issue

Progress to date

- Default methodology developed for SCAPA
- Published in Applied Occupational and Environmental Hygiene 14(9), 609-617, ’99
- Many differences between chemical and radiological risk guidelines & consequences
- Exposure to either may exacerbate health consequences of the other
- Radiological guidelines low by comparison with chemicals in terms of health effects

Mixture methodology summary

- Calculate hazard index ($HI_i = Conc_i/Limit_i$) for each chemical “i” in mixture
- Classify components of mixture by chemical-specific health code numbers (HCNs)
- HCNs identify toxic endpoints of chemicals
- Add the HIs for chemicals with same HCNs
- Use knowledge of interactive effects if any

Problems

- Radiation doses would have to exceed current guidelines substantially to have any effect on chemical exposure consequences
- Although mixture methodology approved for emergency planning, little benefit unless also other DOE departments also involved
- Significant opposition to prescriptive approach
- However, qualitative analysis not very useful

Next steps

- Methodology needs review and approval of other DOE departments
- Expect inclusion in next revision of Emergency Management Guide
- Recommend inclusion in DOE-EH Chemical Management System Guide
- Publish health code numbers (HCNs) for 1000 chemicals and automate mixture methodology

Recommendations to senior management

- Approve adequate replacement for 5481.1B
- Include consideration of consequences of exposure to mixtures of chemicals, as well as simultaneous chemicals and radiation
- All DOE Offices should adopt methodology
- Integrated Safety Management incomplete without inclusion of this issue